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ENVIRONMENTAL GOVERNANCE IN BRAZIL: SYNERGIES BETWEEN ACTIVE RECYCLING AGENT AARs AND SMALL CONSTRUCTION AND DEMOLITION WASTE (CDW) GENERATORS TO ADDRESS SGDs

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Resumo
Governance is one of the most important aspects for ensuring effective environmental management and conservation actions and it involves network coordination between governments, companies, civil society organizations, and local communities. In urban areas of Brazil, waste collectors are key players in the National Solid Waste Policy (PNRS), aligning themselves with the recycling industry. Its role in collecting and separating recyclable materials boosts the circular economy, reducing the amount of waste sent to landfills (Green Gases Emission as the transport is by truck to places far away from urban centers) and thus minimizing some environmental harm. They also support sustainable development and social equity, in addition to generating jobs and income. The objective of this paper is to document the process of inserting Active Recycling Agents (in Portuguese – AARs) into the PNRS consolidation by bridging micro-generators of waste to consumers (needing those materials) in their acting region.. The core of this study is one of the author`s experiences in using some AAR in the process of his home renovation in peripheral neighborhoods of São Paulo Municipality. Having been classified as Class A and D by Brazilian regulations, where Class A (ceramic tiles) uses natural resources and D (house paint) is considered to be toxic, the reuse of these material is both environmentally friendly and economic viable (for the AAR and the consumer). By creating a G2C (Generator to Consumer) trade, AARs became a strategy to foster neighborhood waste management ecosystems and contribute to environmental governance in this community. The two examples of materials presented in this paper demonstrated that through synergic actions between small solid waste generators and Active Recycling Agents (AARs) it is possible to address Sustainable Development Goal - SDGs number 17 in a peripheric neighborhood of São Paulo. Brazil's extensive biodiversity and abundant natural resources necessitate environmental governance. The Construction and Demolition Waste - CDW management by AARs ensures the responsible use of natural resources, promotes sustainable development, and combats climate change, in addition to helping preserve ecosystems and reduce poverty. Environmental governance also enhances the quality of life of local populations, attracts investments, and reinforces Brazil's international reputation as a nation dedicated to sustainable development and environmental preservation. Nevertheless, to improve the results of this network, we must overcome the last mile challenge, proper storage, capacity building, municipality support and sensibilization of the community.

Palavras Chave
Construction and Demolitin Waste Management, Environmental Governance, SDG 17 - Partnerships

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INTRODUCTION

Environmental governance is a set of practices, policies, and processes that aim to ensure the sustainable management of natural resources and the protection of the environment. It involves network coordination between governments, companies, civil society organizations, and local communities to promote biodiversity conservation, waste and pollution reduction, and climate change mitigation (Seixas, 2020). Civil society includes the general population, who strategically drive for environmental protection and sustainable public policy through petitions, protests, and individual or collective actions.

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity. At a global level, the efforts of different stakeholders have focused on the 17 SDGs and their 169 targets. In this sense, Environmental governance is vital to achieving the UN 2030 Agenda. Seixas and colleagues (2020) recently highlighted that civil society and Brazilian scientists' participation in construction debates has led to advancements toward SDG accomplishments in our country.

Construction and demolition activities, such as home and small business renovations, produce large amounts of waste materials. It is estimated that approximately 35% of the construction and demolition waste (CDW) generated worldwide is sent directly to landfills without undergoing any additional treatment (Menegaki, & Damigos, 2018).

In Brazil, the National Solid Waste Policy (in Portuguese, Política Nacional de Resíduos Sólidos —PNRS), established by Law No. 12,305/10, contains instruments that could enable the nation to make the necessary progress in addressing the primary environmental, social, and economic issues that result from the insufficient management of solid waste like CDW. Nevertheless, it is common sense that solid urban waste management still presents technological, political, and economic obstacles.

Additionally, to the waste management challenges, Brazilian economy and urbanization have been unable to absorb and retain a significant portion of the population in the formal employment market, resulting in the current presence of 38.1 million informal workers. Unemployment and other social challenges are more prevalent among workers who lack qualifications. Some Brazilians can survive, thanks to waste collection and disposable products commerce.

In the context of this research, the waste collector will be referred as the Active Recycling Agent (AAR in Portuguese) to reflect its prominence as the central figure in the activity. Besides, the Portuguese term "catadores" (Waste collector) has been interpreted as a deficient and unequal simplification of the economic potential of the AAR.

The present work will emphasize the role of the Active Recycling Agent (AAR) as a node on a network, bridging the community in a peripheric region of São Paulo to contribute to the "SDG 17—Partnerships for the Goals" in the challenges of construction and demolition waste management by reducing waste disposal, fostering a circular economy, and generating income through sustainable value creation.

Also, this research directly impacts SDG 11 - Sustainable cities and communities; SDG 12 - Responsible consumption and production; and SDG 13 - Climate action. Furthermore, it seems to be also related in some extension to SDG 5 - Gender equality; SDG 6 - Clean water and sanitation; and SDG 8 - Decent work and economic growth. Some of the remaining SDGs will be indirectly

impacted, as inadequate toxic waste disposal and its environmental consequences may affect life on earth (SDG 15) and water resources (SDG 14), besides human Good health and well-being (SDG 3).

The objective of this research shows how the Active Recycling Agent acts as a catalyst for the reuse of waste from small renovations in a neighborhood on the outskirts of SP, contributing to the SDGs and creating sustained economic value.

CONTEXT INVESTIGATED

There are some regulations regarding the recycling production chain of construction or demolition of home and small business renovations. In Brazil, it is advisable to obtain information on the appropriate disposal of construction debris prior to renovating or redecorating a property, as this type of material cannot be disposed of without concern.

Proper disposal of construction waste is regulated by specific laws, with non-compliance resulting in legal penalties. To avoid these issues, the National Environmental Council (CONAMA), establishes guidelines, criteria, and procedures for managing waste in civil construction to minimize environmental impacts. In 2015, Resolution 469 was published by CONAMA, which revised the classification of unused housing paint cans.

The waste classification of CONAMA (2024) is described below:

- Class A- Including reusable or recyclable debris from construction, demolition, renovations, repairs, and other infrastructure projects, this category encompasses this type of waste. For instance, soil from earthworks, mortar, concrete, bricks, blocks, **tiles**, and ceramics.
- Class B: Plastics, paper, cardboard, metals, glass, wood, and empty packaging from building paints and plaster that cannot be utilized on site are all examples of waste that can be recycled for alternative purposes.
- Class C Materials that lack a technology or process for recycling or reuse.
- Class D: These are hazardous waste products that are generated during the construction process, including **paints, solvents, and oils**. Additionally, they may be contaminated or harmful to health as a result of demolitions, renovations, and repairs of industrial facilities, radiological clinics, and other structures. Tiles and other objects and materials that contain asbestos or other harmful products are also included.

Additionally, in 2020, the new legal framework for basic sanitation in Brazil was signed (Brasil, 2020), Law No. 14,026, which gives the National Water and Basic Sanitation Agency (ANA) the competence to instruct standards for the regulation of public services of basic sanitation and articulate the National Solid Waste Plan (PNRS), Law (Brasil, 2010). The objects of this legal framework are certain types of urban solid waste that the small generator cannot manage, such as waste from small renovations, operated by the city hall through voluntary delivery points.

As most of waste collectors are primarily involved in the sorting and informal collection of materials, a relatively unfavorable position that reveals four significant limitations: i) low collector remuneration ii) unstable infrastructure for collection and sorting; iii) limited scope for selective collection (De Paula; Lima; Alves De Souza, 2016); and iv) an incompleteness of the Recycling Social System (RSS).

In this research will be analyzed the potential of AARs to contribute to waste reduction construction and demolition waste (CDW) of ceramic French tiles (Class A) and gallons of leftover wall paint from indoor and outdoor uses (Class D) concerning economic and environmental aspects.

DIAGNOSIS OF THE PROBLEM SITUATION

The action-research method is employed in this study to establish a more robust relationship between the researcher and the evaluated group. This methodology, which is collaborative, fosters the development of a cooperative process for the generation of specific knowledge about the group's daily

experiences and encourages discussions. As a result, this methodology deviates from the traditional academic and bureaucratic research orientation by incorporating dialogues as a component capable of revealing subjectivities (Thiollent, 2005).

From January to August 2024, data was collected through informal interviews (dialogues) with some AARs and observations, as a member of the authorship team was responsible for executing several refurbishment endeavors in a property located in the southern region of São Paulo, specifically within the Campo Limpo district (Figure 1).

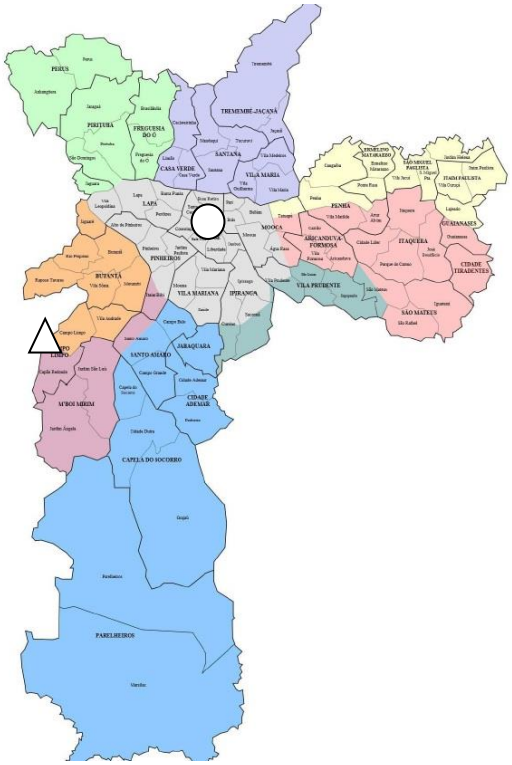

Figure 1. Campo Limpo District (Δ) and downtown São Paulo (O). Brazil,

Active Recycling Agent refers to the four waste collectors who frequented the street where the building being restored is located, which part of their daily work considered ‘the need to search for items with economic value discarded to sell to this article author, for use in the refurbishing’

Civil construction is one of the oldest human activities and has been done artisanally since the beginning, generating considerable amounts of waste. It also overuses non-renewable resources (Lintz, 2012). The construction industry uses 20–50% of the planet's resources (dos Santos, 2011). RCD made up 41 to 70% of urban solid waste (MSW) in Brazilian cities a decade ago (Larrucia 2014), and recent data show no change (Abrecon, 2020). Renovations and construction of homes and businesses are phenomena that occur regardless of social class in Brazil, and in urban areas, where important agents shape policies and programs, reflect social inequities including social exclusion, and socio-spatial segregation (Leal, 2020; Mafra, 2024].

Tiles make up an essential part of any home, protecting the space from climate variations and external temperatures. French tile is a ceramic covering made of clay, with a flat, rectangular shape, and slightly domed edges to facilitate fitting. Used for around 300 years, it is popular in Brazil and other countries. Ideal for roofs with steep slopes and coastal areas due to its resistance to salt spray, its installation requires specialized professionals and a resistant structure, as it tends to break easily during the process (Figure 2).

Figure 2. A roof with French tiles (view from below), stock of tiles and on left, some broken tiles.

They are ubiquitous in old constructions in Campo Limpo District, as in other locations in Brazil; each m2 corresponds to 16 tiles, and one tile weighs 4.0 kg, so they need a strong ceiling structure and an experienced builder to be mounted. Because of these features, alternative materials have been used nowadays (such as fiber cement tile that weighs 90% less).

Regarding French tiles, accidents or natural wear and tear often create the need for replacement. As it is a complex material to deal with (weight and fragility), the owners' usual decision is to replace everything. The presence of the AAR could create a new process, as what is removed from one home has the potential to be used for minor repairs in others.

Removing ceramic tiles without breaking is not a simple task (one of the authors experienced around 130 out of 1500). Besides, finding a place to store them could also be a challenge (Figure 2). However, the AAR activity can make it possible to save money by replacing some broken tiles instead of changing them all if someone offers, starting a trade involving a Generator and a Consumer in this neighborhood.

The disposal of surplus wall or ceiling paint in renovations or constructions can be subject to technical difficulties. The packaging and expiration date of the mixture can make it difficult to reuse materials. The most common practice in places without a reverse logistics structure is irregular waste disposal in common trash.

As previously mentioned, this is a Class D waste, paint residues cannot be disposed of in some locations due to toxicity to soil and water resources. Besides, in places without sewage treatment, the problem can be even greater, including damage to areas that should not have contact with this chemical material. (negative impact on biodiversity).

PROPOSED INTERVENTION:

Last-mile distribution, which originates from the field of logistics, is the process and system of collecting, transporting, and distributing products in an urban environment considering the location the consumer prefers as the final destination (He, 2020). This concept can be applied to the context of this work. Similar to the logistical problem of establishing physical links for supply routes between the City Logistics Center (CLC) and consumers, the lack of storage space for accumulated materials is hindering the progress of sustainability efforts for the AAR.

At this moment, AARs cannot separate (sort) sets and pieces – curate and analyze the sales potential of these pieces or raw material. Furthermore, there is great variability in materials and components with different potential for reuse or recycling when collecting waste from small

generators. If the AAR does not have space to wait for the buyer's moment of need, this material will also go to the landfill

The present G2C case (mediated by AARs) was conducted by opportunity, as the purchases of tiles and paints were made by specific requests of the buyer (one of the authors), sometimes in advance (or delayed - saved for later) of the renovation project demand.

A stock of tiles can also negatively impact the sanitary conditions of the building. In addition to taking up a large space, they can house stagnant water and urban pests. In this sense, it is important to dispose of them or find someone interested in acquiring them, using the AARs for prospecting possible buyers. Also, the demolition of roofs to keep the French tiles intact is a threat, as handling fragile and heavy materials increases the time spent on renovation (and the contractor earns hourly). Consequently, by the time the AARs have a demand, it could be possible that he cannot find an adequate number of tiles to sell.

RESULTS OBTAINED

In the development of this project, it was observed that the AAR activity was able to expand the potential for reinserting parts and construction elements into people's lives through the connection of small generators to consumers (G2C).

The level of Environmental Governance in Campo Limpo District is on the rise because of the increasing number of waste collectors serving as AARs. The most difficult aspect of the French tiles was storing the material prior to a customer's request. On the other hand, if the AAR reaches its full potential through networking, it receives materials that can be offered to other residents of the neighborhood, reducing the need for purchases.

Despite possible difficulties in establishing G2C, the process is economically attractive for AAR and the buyer. In general trade, a thousand French tiles cost around US$500.00 or R$3,000.00, but if a few units are needed, for an AAR it is easy to look for places that dispose of entire tiles to sell for small damages (about a dollar the pair).

Better results were obtained by trading house paint. The AAR sold 17 cans during the period of this study for one of the authors, generating a revenue of approximately USD 60.00. For the buyer, the volume in the cans ranged from 20 to 40%, thus, what was left for use amounted to five liters of 3.6 L (the average price for a 3,6 gallon of acrylic pain is USD 60,00) - in short, for the buyer it was an 80% discount.

This final example demonstrates the importance of AAR in the community, as the life cost for the lower classes in Brazil may hinder their ability to paint their homes readily.

It is important to note that this accomplishment (reusing paint leftovers) could be enhanced by a fundamental understanding of chemistry, as there are a variety of solutions and solvents available. The most commonly used options include PVA latex, acrylic paint, washable paint, epoxy paint, and synthetic enamel. So, it is not obvious how to combine scraps to increase the volume of liquid material for painting.

TECHNOLOGICAL-SOCIAL CONTRIBUTION

The inclusion of AARs in CDW has a positive impact on reducing waste and preserving the environment. By establishing themselves as a part of a community network (SDG 17) linking small business and families, they increase recycling, save natural resources, reducing indirectly greenhouse gas emissions and pollution.

Nevertheless, this work has presented significant challenges to overcome and results which reinforce that AAR acts as a node in the recycling production chain in peripheric regions in big cities. Furthermore, they reduce space consumption in landfills, promote the circular economy and raise awareness among the population about the importance of correct waste disposal.

The success of this proposition is contingent upon the speed of G2C (networking). In this regard, a potential intervention would be the establishment of a Matching space, which would facilitate the interchange of materials between AARs, as they have the potential to complement one another in the region.

In the two examples in this research, AAR's duties are: (a) to create connection with generators; (b) to identify materials with the potential to generate economic value; (c) to improve G2C sales; (d) to recognize opportunities to avoid disposal of apparently unusable items. It is evident that the process conducted by AARs is still incomplete, and the potential for the insertion of companies and the public sector to overcome these difficulties. Environmental governance is more effective when there are more stakeholders in the network.

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